

10/501309

containing ethylene copolymer (FCEC) obtained by the
copolymerization of ethylene with suitable fluorine-
containing comonomer compounds, wherein the FCEC
comprises from about 0.5 wt% to about 40 wt% of a
5 fluorine-containing comonomer compound and from about
30 wt% to about 99.5 wt% ethylene.

In another aspect, the present invention is a
microprobes membrane comprising a fluorine containing
ethylene copolymer (FCEC) obtained by the
10 copolymerization of ethylene with suitable fluorine-
containing comonomer compounds, wherein the FCEC
comprises from about 0.5 wt% to about 40 wt% of a
fluorine-containing comonomer compound and from about
30 wt% to about 99.5 wt% ethylene, wherein the membrane
15 is useful as protection against permeation of liquids
through the membrane.

In still another aspect, the present invention is
a flash spun plexifilamentary product comprising a
fluorine containing ethylene copolymer (FCEC) obtained
20 by the copolymerization of ethylene with suitable
fluorine-containing comonomer compounds, wherein the
FCEC comprises from about 0.5 wt% to about 40 wt% of a
fluorine-containing comonomer compound and from about
30 wt% to about 99.5 wt% ethylene.

25 In yet another aspect, the present invention is a
melt spun fibrous article comprising a fluorine
containing ethylene copolymer (FCEC) obtained by the
copolymerization of ethylene with suitable fluorine-
containing comonomer compounds, wherein the FCEC
30 comprises from about 0.5 wt% to about 40 wt% of a
fluorine-containing comonomer compound and from about
30 wt% to about 99.5 wt% ethylene, wherein the fibrous

herein, is any monomer that is polymerized in the presence of at least one other monomer to produce a copolymer of the present invention. For example, a copolymer can be the product of polymerization of two, three, four, or five comonomers, or more. Where the concentration of all but one of the comonomers is specified, the concentration of the remaining comonomer can be deduced by subtraction of the known constituents from 100 wt%, that is, the total wt% of the copolymer.

Suitable fluorine containing comonomers are described in U.S. Pat. No. 2,803,615; U.S. Pat. No. 2,642,416; US. Pat. No. 2,826,564; U.S. Pat. No. 3,102,103; US. Pat. No. 3,282,905; and US. Pat. No. 3,304,278, for example. Suitable fluorine-containing comonomers are fluorinated acrylate or methacrylate esters of the general formula: Cf-L-O-CO-CR=CH_2 , wherein:

(i) Cf is a fluorinated aliphatic group having at least 4 carbon atoms wherein the aliphatic group can be: straight chain or branched; acyclic or cyclic; and can include heteroatoms such as nitrogen, oxygen, and/or sulfur. It is preferable that Cf is a perfluorinated aliphatic group of the formula $\text{C}_n\text{F}_{2n+1}$, wherein n is an integer from 3 to 20;

(ii) L is a linking group that connects the fluorinated aliphatic group with the (meth)acrylate group, wherein L can contain from 1 to 10 carbon atoms, and can optionally include oxygen, nitrogen, or sulfur-containing groups, or combinations thereof; L can be straight-chain or branched, cyclic alkylene, arylene, arylalkylene,

polymerization is preferred herein. Conventional methods for preparing ethylene copolymers are described in patented literature and reference textbooks. For example, an ethylene copolymerization process is
5 described in U.S. Pat. No. 4,351,931.

Copolymers of the present invention are melt-processable polymers and can be processed by methods used with conventional ethylene copolymers. For example, copolymers of the present invention can be
10 molded, extruded, blown, or spun to yield molded parts, fibers, or films, for example, in the same manner as conventional polyethylene polymers and copolymers.

Unlike conventional ethylene copolymers, polymers of the present invention have low surface tension.
15 Copolymers and copolymer blends of the present invention have surface tensions of less than those of conventional polyethylene and/or polypropylene polymers and copolymers. Copolymers (including blends) of the present invention have surface tensions of less than
20 about 32 dyne/cm. Preferably, the surface tension is less than about 28 dyne/cm, and more preferably less than about 24 dyne/cm.

In another embodiment, the present invention is a terpolymer comprising in addition to the above
25 comonomers, from about 0.5 wt% to about 5 wt% of a terpolymer X, wherein X is a reactive functional comonomer. For example, X can be glycidyl methacrylate, maleic anhydride, or a half-ester of maleic anhydride and/or derivatives thereof.
30 Preferably, the terpolymer includes from about 1 wt% to about 4.5 wt% of X, more preferably from about 1.5 wt%

to about 4 wt% of X. Most preferably the terpolymer comprises from about 2 wt% to about 4 wt% of X.

In still another embodiment, the present invention is a terpolymer comprising, in addition to the ethylene and fluoroalkyl comonomers described hereinabove, from about 0.5 wt% to about 50 wt% of a terpolymer Y, wherein Y is a vinyl acetate or an acrylate comonomer, such as methyl acrylate and butyl acrylate. Preferably Y is included in an amount of from about 2 wt% to about 45 wt%, and more preferably from about 5 wt% to about 40 wt%. Most preferably, Y is included in an amount of from about 5 wt% to about 35 wt%. Preferably Y is a vinyl acetate monomer.

In another embodiment, the present invention is a terpolymer comprising, in addition to the ethylene and fluoroalkyl comonomers described hereinabove, from about 1.0 to about 20 wt% of a terpolymer Z, wherein Z is acrylic acid or methacrylic acid comonomer. Preferably Z is included in an amount of from about 1.5 wt% to about 18 wt%, and more preferably from about 2.5 wt% to about 17 wt%. Most preferably Z is included in an amount of from about 3 wt% to about 15 wt%.

In still another embodiment, the present invention is a fluorine-containing ethylene copolymer comprising, in addition to at least 40 wt% ethylene and from 0.5 wt% to about 40 wt% fluoroalkyl comonomer, any combination of at least two comonomers selected from the group consisting of X, Y, and Z in a total amount of from about 0.5 wt% to about 59.5 wt%. Preferably the two comonomers are present in a total amount of from about 2 wt% to about 50 wt%, more preferably in an

CLAIMS:

1. A film comprising a fluorine containing ethylene copolymer (FCEC) obtained by the copolymerization of ethylene with suitable fluorine-containing comonomer compounds, wherein the FCEC comprises from about 0.5 wt% to about 40 wt% of a fluorine-containing comonomer compound and from about 30 wt% to about 99.5 wt% ethylene.
2. A fiber comprising a fluorine containing ethylene copolymer (FCEC) obtained by the copolymerization of ethylene with suitable fluorine-containing comonomer compounds, wherein the FCEC comprises from about 0.5 wt% to about 40 wt% of a fluorine-containing comonomer compound and from about 30 wt% to about 99.5 wt% ethylene wherein the fiber is obtained by a melt-blowing process.
3. An article having a composite or multilayer structure comprising an outer layer comprising: a fluorine containing ethylene copolymer (FCEC) obtained by the copolymerization of ethylene with suitable fluorine-containing comonomer compounds, wherein the FCEC comprises from about 0.5 wt% to about 40 wt% of a fluorine-containing comonomer compound and from about 30 wt% to about 99.5 wt% ethylene.
4. A microporous membrane comprising a fluorine containing ethylene copolymer (FCEC) obtained by the copolymerization of ethylene with suitable fluorine-containing comonomer compounds, wherein the FCEC comprises from about 0.5 wt% to about 40 wt% of a

fluorine-containing comonomer compound and from about 30 wt% to about 99.5 wt% ethylene, wherein the membrane is useful as protection against permeation of liquids through the membrane.

5

5. A flash spun plexifilamentary product comprising a fluorine containing ethylene copolymer (FCEC) obtained by the copolymerization of ethylene with suitable fluorine-containing comonomer compounds, wherein the FCEC comprises from about 0.5 wt% to about 40 wt% of a fluorine-containing comonomer compound and from about 30 wt% to about 99.5 wt% ethylene.

6. A melt spun fibrous article comprising a fluorine containing ethylene copolymer (FCEC) obtained by the copolymerization of ethylene with suitable fluorine-containing comonomer compounds, wherein the FCEC comprises from about 0.5 wt% to about 40 wt% of a fluorine-containing comonomer compound and from about 30 wt% to about 99.5 wt% ethylene, wherein the fibrous products are obtained by melt spinning or multicomponent fiber spinning a FCEC or a blend thereof.